IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Jun Koyama
Serial No. : Unassigned
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Title : LIQUID CRYSTAL DISPLAY DEVICE AND DRIVING METHOD THEREOF

Art Unit : Unknown
Examiner : Unknown

Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Prior to examination, please amend the application as follows:

In the claims:

Amend claims 2-8, 10, 12-18, 20, 21, 24-30, 32, 37-43, 45-48, 50-52 and 54-56 as follows:

2. A device according to claim 1, wherein the storage circuits comprise static memory (SRAM).

3. A device according to claim 1, wherein the storage circuits comprise ferroelectric memory (FeRAM).

4. A device according to claim 1, wherein the storage circuits comprise dynamic memory (DRAM).

5. A device according to claim 1, wherein the storage circuits are formed on a glass substrate.

6. A device according to claim 1, wherein the storage circuits are formed on a plastic substrate.

7. A device according to claim 1, wherein the storage circuits are formed on a stainless substrate.

8. A device according to claim 1, wherein the storage circuits are formed on a monocrystalline wafer substrate.

10. The electronic device according to claim 9, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

12. A device according to claim 11, wherein the storage circuits comprise a static memory (SRAM).

13. A device according to claim 11, wherein the storage circuits comprise ferroelectric memory (FeRAM).

14. A device according to claim 11, wherein the storage circuits comprise dynamic memory (DRAM).

15. A device according to claim 11, wherein the storage circuits are formed on a glass substrate.

16. A device according to claim 11, wherein the storage circuits are formed on a plastic substrate.

17. A device according to claim 11, wherein the storage circuits are formed on a stainless substrate.

18. A device according to claim 11, wherein the storage circuits are formed on a monocrystalline wafer substrate.

20. The electronic device according to claim 19, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

21. A liquid crystal display device having a plurality of pixels, each of the plurality of pixels comprising:

a source signal line;

n write-in gate signal lines (n is an integer, where $2 \leq 5$ n);

n read gate signal lines;

n write-in transistors, gate electrodes of the n write-in transistors being respectively electrically connected to any one of the different n write-in gate signal lines;

n read transistors, gate electrodes of the n read transistors being respectively electrically connected to any one of the different n read gate signal lines;

n x m storage circuits for storing m frames (m is an integer, where $1 \leq$ m) of an n bit digital image signal;

n write-in storage circuit selection portions;

n read storage circuit selection portions having m signal output portions, respectively; and

a liquid crystal element,

wherein one of a source and a drain region of the n write-in transistor is electrically connected to a source signal line, and the other is electrically connected to any one of the different signal input portions of the n write-in storage circuit selection portions;

wherein the m signal output portions respectively are electrically connected to signal input portions of the different m storage circuits;

wherein the m signal input portions respectively are electrically connected to the signal output portions of the different m storage circuits; and

wherein one of the source region and the drain region of n read transistors is electrically connected to any one of the different signal output portions of the n read storage circuit selection portions, and the other is electrically connected to one electrode of the liquid crystal element.

24. A device according to claim 21, wherein the storage circuits comprise static memory (SRAM).

25. A device according to claim 21, wherein the storage circuits comprise ferroelectric memory (FeRAM).

26. A device according to claim 21, wherein the storage circuits comprise dynamic memory (DRAM).

27. A device according to claim 21, wherein the storage circuits are formed on a glass substrate.

28. A device according to claim 21, wherein the storage circuits are formed on a plastic substrate.

29. A device according to claim 21, wherein the storage circuits are formed on a stainless substrate.

30. A device according to claim 21, wherein the storage circuits are formed on a monocrystalline wafer substrate.

32. The electronic device according to claim 31, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

37. A device according to claim 33, wherein the storage circuits comprise static memory (SRAM).

38. A device according to claim 33, wherein the storage circuits comprise ferroelectric memory (FeRAM).

39. A device according to claim 33, wherein the storage circuits comprise dynamic memory (DRAM).

40. A device according to claim 33, wherein the storage circuits are formed on a glass substrate.

41. A device according to claim 33, wherein the storage circuits are formed on a plastic substrate.

42. A device according to claim 33, wherein the storage circuits are formed on a stainless substrate.

43. A device according to claim 33, wherein the storage circuits are formed on a monocrystalline wafer substrate.

45. The electronic device according to claim 44, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

46. A method of driving a liquid crystal display device displaying an image with an n bit digital image signal (n is an integer, where $2 \leq n$), wherein the liquid crystal display device comprises a source signal line driver circuit including a shift register and a latch circuit, a gate signal line driver circuit, and a plurality of pixels, the method comprising:

in the source signal line driver circuit, outputting a sampling pulse from the shift register and inputting the sampling pulse to the latch circuit,

in the latch circuit, holding the digital image signal in accordance with the sampling pulse, and writing the held digital image signal to a source signal line,

in the gate signal line driver circuit, outputting a gate signal line selection pulse to select a gate signal line, and

in pixels in a row where the gate signal line is selected, performing write in of an n bit digital image signal input from the source signal line to the storage circuit and reading of the n bit digital image signal stored in the storage circuit.

47. A method according to claim 46, further comprising, in a display period of a still image, stopping the source signal line driver circuit by repeatedly reading the n bit digital image signal stored in the storage circuit to display the still image.

48. A method according to claim 46, further comprising using the method of driving the liquid crystal display device in an electronic device.

50. A method of driving a liquid crystal display device displaying an image with an n bit digital image signal (n is an integer, where $2 \leq n$), wherein the liquid crystal display device comprises a source signal line driver circuit including a shift register, a latch circuit, a gate signal line driver circuit, and a plurality of pixels, the method comprising:

in the source signal line driver circuit, outputting a sampling pulse from a shift register and inputting the sampling pulse to the latch circuit,

in the latch circuit, holding the digital image signal in accordance with the sampling pulse and writing the held digital image signal to a source signal line,

in the gate signal line driver circuit, outputting a gate signal line selection pulse and selecting gate signal lines sequentially from a first row, and

in the plurality of pixels, performing write in of the n bit digital image signal sequentially from the first row.

51. A method according to claim 50, further comprising, in a display period of a still image, stopping the source signal line driver circuit by repeatedly reading the n bit digital image signal stored in the storage circuit to display the still image.

52. A method according to claim 50, further comprising using the method of driving the liquid crystal display device in an electronic device.

54. A method of driving a liquid crystal display device displaying an image with an n bit digital image signal (n is an integer, where $2 \leq n$), wherein the liquid crystal display device comprises a source signal line driver circuit including a shift register, a latch circuit, a gate signal line driver circuit, and a plurality of pixels, the method comprising:

in the source signal line driver circuit, outputting a sampling pulse from a shift register and inputting the sampling pulse to the latch circuit,

in the latch circuit, holding the digital image signal in accordance with the sampling pulse and writing the held digital image signal to a source signal line,

in the gate signal line driver circuit, outputting a gate signal line selection pulse by specifying an arbitrary row of the gate signal lines, and

in the plurality of pixels, performing write in of the n bit digital image signal in an arbitrary row where the gate signal line is selected.

55. A method according to claim 54, further comprising, in a display period of a still image, stopping the source signal line driver circuit by repeatedly reading the n bit digital image signal stored in the storage circuit to display the still image.

56. A method according to claim 54, further comprising using the method of driving the liquid crystal display device in an electronic device.

Add claims 58, 59 and 60 as follows:

--58. A device according to claim 11, wherein $m > 1$.

59. A device according to claim 21, wherein $m > 1$.

60. A device according to claim 33, wherein $m > 1$.--

REMARKS

The amendments to the claims made herein are to correct minor grammatical errors and to place the application in better form for examination. No new matter is added.

Attached is a marked-up version of the changes being made by the current amendment.

Applicant asks that all claims be examined. Please apply any charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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Version with markings to show changes made

In the claims:

Claims 2-8, 10, 12-18, 20, 21, 24-30, 32, 37-43, 45-48, 50-52 and 54-56 have been amended as follows:

2. (Amended) A device according to claim 1, wherein the storage **[circuit is a]** circuits comprise static memory (SRAM).

3. (Amended) A device according to claim 1, wherein the storage **[circuit is a]** circuits comprise ferroelectric memory (FeRAM).

4. (Amended) A device according to claim 1, wherein the storage **[circuit is a]** circuits comprise dynamic memory (DRAM).

5. (Amended) A device according to claim 1, wherein the storage **[circuit is]** circuits are formed on a glass substrate.

6. (Amended) A device according to claim 1, wherein the storage **[circuit is]** circuits are formed on a plastic substrate.

7. (Amended) A device according to claim 1, wherein the storage **[circuit is]** circuits are formed on a stainless substrate.

8. (Amended) A device according to claim 1, wherein the storage **[circuit is]** circuits are formed on a monocrystalline wafer substrate.

10. (Amended) **[A method]** The electronic device according to claim 9, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

12. (Amended) A device according to claim 11, wherein the storage **[circuit is]** circuits comprise a static memory (SRAM).

13. (Amended) A device according to claim 11, wherein the storage **[circuit is a]** circuits comprise ferroelectric memory (FeRAM).

14. (Amended) A device according to claim 11, wherein the storage **[circuit is a]** circuits comprise dynamic memory (DRAM).

15. (Amended) A device according to claim 11, wherein the storage **[circuit is]** circuits are formed on a glass substrate.

16. (Amended) A device according to claim 11, wherein the storage **[circuit is]** circuits are formed on a plastic substrate.

17. (Amended) A device according to claim 11, wherein the storage **[circuit is]** circuits are formed on a stainless substrate.

18. (Amended) A device according to claim 11, wherein the storage **[circuit is]** circuits are formed on a monocrystalline wafer substrate.

20. (Amended) **[A method]** The electronic device according to claim 19, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

21. (Amended) A liquid crystal display device having a plurality of pixels, each of the plurality of pixels comprising:

a source signal line;

n write-in gate signal lines (n is an integer, where $2 \preceq 5$ n);

n read gate signal lines;

n write-in transistors, gate electrodes of the n write-in transistors being respectively electrically connected to any one of the different n write-in gate signal lines;

n read transistors, gate electrodes of the n read transistors being respectively electrically connected to any one of the different n read gate signal lines;

n x m storage circuits for storing m frames (m is an integer, where $1 \preceq m$) of an n bit digital image signal;

n write-in storage circuit selection portions;

n read storage circuit selection portions having m signal output portions, respectively; and

a liquid crystal element,

wherein one of a source and a drain region of the n write-in transistor is electrically connected to a source signal line, and the other is electrically connected to any one of the different signal input portions of the n write-in storage circuit selection portions;

wherein **[and]** the m signal output portions respectively are electrically connected to signal input portions of the different m storage circuits;

wherein the m signal input portions respectively are electrically connected to the signal output portions of the different m storage circuits; and

wherein one of the source region and the drain region of n read transistors is electrically connected to any one of the different signal output portions of the n read storage circuit selection portions, and the other is electrically connected to one electrode of the liquid crystal element.

24. (Amended) A device according to claim 21, wherein the storage **[circuit is a]** circuits comprise static memory (SRAM).

25. (Amended) A device according to claim 21, wherein the storage **[circuit is a]** circuits comprise ferroelectric memory (FeRAM).

26. (Amended) A device according to claim 21, wherein the storage **[circuit is a]** circuits comprise dynamic memory (DRAM).

27. (Amended) A device according to claim 21, wherein the storage **[circuit is]** circuits are formed on a glass substrate.

28. (Amended) A device according to claim 21, wherein the storage **[circuit is]** circuits are formed on a plastic substrate.

29. (Amended) A device according to claim 21, wherein the storage **[circuit is]** circuits are formed on a stainless substrate.

30. (Amended) A device according to claim 21, wherein the storage **[circuit is]** circuits are formed on a monocrystalline wafer substrate.

32. (Amended) **[A method]** The electronic device according to claim 31, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

37. (Amended) A device according to claim 33, wherein the storage **[circuit is a]** circuits comprise static memory (SRAM).

38. (Amended) A device according to claim 33, wherein the storage **[circuit is a]** circuits comprise ferroelectric memory (FeRAM).

39. (Amended) A device according to claim 33, wherein the storage **[circuit is a]** circuits comprise dynamic memory (DRAM).

40. (Amended) A device according to claim 33, wherein the storage **[circuit is]** circuits are formed on a glass substrate.

41. (Amended) A device according to claim 33, wherein the storage **[circuit is]** circuits are formed on a plastic substrate.

42. (Amended) A device according to claim 33, wherein the storage **[circuit is]** circuits are formed on a stainless substrate.

43. (Amended) A device according to claim 33, wherein the storage **[circuit is]** circuits are formed on a monocrystalline wafer substrate.

45. (Amended) **[A method]** The electronic device according to claim 44, wherein the electronic device is selected from the group consisting of a television, a personal computer, a portable terminal, a video camera or a head mount display.

46. (Amended) A method of driving a liquid crystal display device displaying an image with an n bit digital image signal (n is an integer, where $2 \leq n$), wherein the liquid crystal display device comprises a source signal line driver circuit including a shift register and a latch circuit, a gate signal line driver circuit, and a plurality of pixels, the method comprising:

[wherein] in the source signal line driver circuit, outputting a sampling pulse **[is output]** from **[a]** the shift register and **[input]** inputting the sampling pulse to **[a]** the latch circuit,

[wherein] in the latch circuit, holding the digital image signal **[is held]** in accordance with the sampling pulse, and writing the held digital image signal **[is written in]** to a source signal line,

[wherein] in the gate signal line driver circuit, outputting a gate signal line selection pulse **[is output]** to select a gate signal line, and

[wherein] in **[respective plurality of]** pixels**[,]** in a row where the gate signal line is selected, performing write in of an n bit digital image signal input from the source signal line to the storage circuit**[,]** and reading of the n bit digital image signal stored in the storage circuit **[is performed]**.

47. (Amended) A method according to claim 46, **[wherein]** further comprising, in a display period of a still image, stopping the source signal line driver circuit **[is stopped]** by repeatedly reading the n bit digital image signal stored in the storage circuit to display the still image.

48. (Amended) A method according to claim 46, **[wherein said]** further comprising using the method of driving the liquid crystal display device **[is used]** in an electronic device.

50. (Amended) A method of driving a liquid crystal display device displaying an image with an n bit digital image signal (n is an integer, where $2 \leq n$), wherein the liquid crystal display device comprises a source signal line driver circuit including a shift register, a latch circuit, a gate signal line driver circuit, and a plurality of pixels, the method comprising:

[wherein] in the source signal line driver circuit, outputting a sampling pulse **[is output]** from a shift register and **[input]** inputting the sampling pulse to **[a]** the latch circuit,

[wherein] in the latch circuit, holding the digital image signal **[is held]** in accordance with the sampling pulse**[,]** and writing the held digital image signal **[is written in]** to **[the]** a source signal line,

[wherein] in the gate signal line driver circuit, outputting a gate signal line selection pulse **[is output]** and **[the]** selecting gate signal lines **[are selected]** sequentially from **[the]** a first row, and

[wherein] in the plurality of pixels, performing write in of the n bit digital image signal sequentially from the first row **[is performed]**.

51. (Amended) A method according to claim 50, **[wherein]** further comprising, in a display period of a still image, stopping the source signal line driver circuit **[is stopped]** by repeatedly reading the n bit digital image signal stored in the storage circuit to display the still image.

52. (Amended) A method according to claim 50, **[wherein said]** further comprising using the method of driving the liquid crystal display device **[is used]** in an electronic device.

54. (Amended) A method of driving a liquid crystal display device displaying an image with an n bit digital image signal (n is an integer, where $2 \leq n$), wherein the liquid crystal display device comprises a source signal line driver circuit including a shift register, a latch circuit, a gate signal line driver circuit, and a plurality of pixels, the method comprising:

[wherein] in the source signal line driver circuit, outputting a sampling pulse **[is output]** from a shift register and **[input]** inputting the sampling pulse to **[a]** the latch circuit,

[wherein] in the latch circuit, holding the digital image signal **[is held]** in accordance with the sampling pulse**[,]** and writing the held digital image signal **[is written in]** to **[the]** a source signal line,

[wherein] in the gate signal line driver circuit, outputting a gate signal line selection pulse **[is output]** by specifying an arbitrary row of the gate signal lines, and

[wherein] in the plurality of pixels, performing write in of the n bit digital image signal **[is performed]** in an arbitrary row where the gate signal line is selected.

55. (Amended) A method according to claim 54, **[wherein]** further comprising, in a display period of a still image, stopping the source signal line driver circuit **[is stopped]** by repeatedly reading the n bit digital image signal stored in the storage circuit to display the still image.

56. (Amended) A method according to claim 54, **[wherein said]** further comprising using the method of driving the liquid crystal display device **[is used]** in an electronic device.